

# Nanocomposites and nanomaterials

## Anionic azo dyes extraction by chitosan-silica hybrid composites from the neutral aqueous solutions

**T.M. Budnyak<sup>1</sup>, M. Błachnio<sup>2</sup>, M. Zienkiewicz-Strzalka<sup>2</sup>,  
A. Deryło-Marczewska<sup>2</sup>, A.W. Marczewski<sup>2</sup>, V.A. Tertykh<sup>1</sup>**

<sup>1</sup> *Chuiiko Institute of Surface Chemistry of National Academy of Sciences of Ukraine, 17 General Naumov Str., 03164 Kyiv, tetyanabudnyak@yahoo.com*

<sup>3</sup> *Maria Curie Skłodowska University, 2 M. Curie Skłodowska Sq., 20-031 Lublin, Poland*

In recent decades, several physical, chemical and biological techniques have been reported to remove dyes from wastewater including adsorption, coagulation, membrane separation, chemical oxidation, photocatalytic degradation, electrochemical and aerobic and anaerobic microbial degradation, etc. Among the numerous techniques for dyes removal, adsorption has shown the best results as it can be used to remove different types of colouring materials. In order to decrease the cost of treatment, attempts have been made to find inexpensive alternative adsorbents. Adsorption on polysaccharide derivatives can be a low-cost procedure of choice in water decontamination for extraction and separation of compounds, and a useful tool for protecting the environment.

In current study, we have synthesized chitosan-silica composites by sol-gel method and physical adsorption of biopolymer. Obtained composites were applied for extraction of the anionic azo dyes from the neutral aqueous solutions. The commercial, anionic dyes, a type of sulfonated azodyes: orange II (OII), acid orange 8 (AO8), orange G (OG), acid red 88 (AR88) and acid red 1 (AR1), which are characterized by one or two sulfonate groups and the presence of bound to aromatic ring azo group (-N=N-) were used for that purpose. These dyes are resistant to biological and chemical degradation. In order to verify applicability of chitosan-silica composites for removing anionic dyes from aqueous solutions the experimental equilibrium and kinetic data of adsorption process are analysed. Additionally thermal behavior of dye-composites systems was investigated.

Comparing the ability of dyes to adsorb on the composite it can be seen that the maximum adsorption AR88 (0.48 mmol/g) exceeds five times that obtained to AR1 (0.09 mmol/g). Adsorption for OII and AO8 are similar (0.25 and 0.20 mmol/g). Dye OG is only slightly better (0.12 mmol/g) removed from the solution than AR1. AR88 as an adsorbate with the highest affinity to the active sites of the composite is distinguished from the other dyes by the presence of two naphthalene rings.

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